SP2 Analysis of Black Carbon from Biomass Burning and Diesel Emissions

A. C. AIKEN[1], S. LIU[1], M. K. DUBEY[1], G. MCMEEKING[2], B. YOKELSON[3], J. SHILLING[4] AND R. ZAVERI[4]

[1]Los Alamos National Laboratory, Los Alamos, NM 87545
[2]Droplet Measurement Technologies, Boulder, CO 80301
[3]University of Montana, Missoula, MT 59812
[4]Pacific Northwest National Laboratory, Richland, WA 99354

Black carbon is considered the 2nd most important global warming factor behind CO2 (Bond *et al*, 2013). However, large uncertainties remain due to BC morphology and mixing state on the extent of the warming that it causes. Core-shell BC is expected to enhance absorption by up to a factor of 2, but has not been observed to this extent in ambient data (Cappa *et al*, 2012). Therefore, it is important to characterize the morphology of BC. A confounding issue is that it is often intermixed both internally and externally with both brown carbon (BrC) and non-absorbing OC. Direct on-line measurements are made with the single particle soot photometer (SP2) from fresh, aged, and laboratory BC to investigate the presence of coatings and enhancements.

BC from concentrated biomass burning plumes are compared with indoor generation of single-source fuels, e.g. ponderosa pine, as sampled during FLAME-IV, including both direct and aged emissions. Our goal is to improve model treatment of BC aging in GCMs in order to help constrain the amount of absorption from BC. Our data shows that while there is a dominance of thickly coated particles, aged BB data also includes particles with near-surface BC as documented by Sedlacek *et al*, 2012. We attempt to understand when these particles are present and how they are formed as a large presence of this particle type would not result in an absorption enhancement for BC. Data from the single source emissions are compared with ambient wildfire data collected in New Mexico, including both near-source and aged BC measurements of several hours to a day of atmospheric aging.

We also report data from chamber studies on diesel particles that were coated with SOA during the SAAS experiments at PNNL. During these experiments it was observed that the SP2 is blind to very heavily coated BC. If found to be prevalent in the atmosphere, this would indicate a low bias for SP2 measurements. This noted caveat warrants more research to determine how prevalent this BC particle type is and how it would be expected to impact climate.